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Decentralised electricity generation through rooftop solar photovoltaics (PVs) in Zambia : a case study of the engineering institute of Zambia (EIZ) office building project, Lusaka

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Abstract.

Whereas there has been significant study and development of national strategic plans on electricity generation from renewable energy in general in Zambia, specific studies and research on decentralised electricity generation via rooftop solar PVs from buildings and their potential to enhance Zambia's electricity generation goals have not systematically been done.

The study applies a case study of the Engineering Institute of Zambia office building that is at construction stage but is determined to incorporate a rooftop solar PV system. Using DesignBuilder and Energyplus simulation software, the building was modelled and analysed for this potential. In addition, based on interview data from various experts and secondary data from national plans, the study evaluated policy, regulatory and market frameworks which could catalyse the increased deployment of such systems in Zambia. Using financial analysis tools of payback period, return on investment and net present value the study undertook a number of business case scenarios in order to conceptualize a responsive business model.

The study finds that from the initial estimate, the available roof space had the capacity to net out the baseline annual electricity consumption of 287,707kWh and generate a surplus of 63,519kWh/year before optimisation. Optimisation of the baseline consumption through a combination of two viable energy efficiency interventions reduced the baseline annual consumption by 35% to 186,904kWh with related payback period of nine years, ROI of 518% over a 25 year analysis period and a NPV of 623,344.00 ZMK. Based on these findings, three business case scenarios for the solar PV system were analysed and two out of the three were adopted. One scenario assumed a net-zero building and another one assumed that the surplus electricity generated on non-business days is exported to the grid were adopted. Following this finding, a business model centred on an integrated energy service company (IESCo) was identified as the most appropriate model to respond to the uptake barriers of this technology and thus leverage on the emerging progressive support mechanisms.

The overall findings of the study thus support the working hypothesis of the study which deemed that through the framework of a responsive business model, decentralised electricity generation through rooftop solar PV can greatly enhance energy security and mitigate GHG-emission for Zambia.

Key words: Decentralised electricity generation, Rooftop solar PV, energy efficiency, grid interactive, business model.